Refine Search

Search Results -

Terms	Documents
L5 and L6	15

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L7

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Monday, June 21, 2004 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L7	l5 and L6	15	L7
L6	vehicle	1746957	L6
L5	l1 and L4	18	L5
L4	crash	33587	L4
L3	l1 and L2	4	L3
L2	pedestrian	15185	L2
L1	peripheral adj sensor	260	L1

END OF SEARCH HISTORY

Search Forms
Search Results
Help
User Searches
Preferences
Logout

Refine Search

Search Results -

Terms	Documents
L1 and L4	14

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L10

Refine Search

Recall Text   Clear   Interrupt

Search History

DATE: Monday, June 21, 2004   Printable Copy   Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L10	l1 and l4	14	L10
L9	l7 and L8	2	L9
L8	impact adj sensor	2734	L8
L7	l5 and L6	2	L7
L6	bumper	73355	L6
L5	l3 and L4	2	L5
L4	pedestrian adj impact	170	L4
L3	l1 same L2	2869	L3
L2	trigger$	459852	L2
L1	safety adj device	63300	L1

END OF SEARCH HISTORY

Refine Search

Search Results -

Terms	Documents
L12 and L13	17

Database:

US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L14

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Monday, June 21, 2004 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR		
L14	l12 and L13	17	L14
L13	crash	33587	L13
L12	l8 and L11	23	L12
L11	l6 and L10	30	L11
L10	rear same impact same pedestrian	159	L10
L9	l7 and L8	1	L9
L8	bumper	73355	L8
L7	l5 and L6	8	L7
L6	restrain$	371166	L6
L5	l3 and L4	13	L5
L4	crash	33587	L4
L3	rear adj side adj impact	79	L3
L2	rear and L1	1	L2
L1	6212456.pn. or 6513831.pn.	4	L1

Refine Search

Search Results -

Terms	Documents
L5 and L6	8

Database:

US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L7

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Monday, June 21, 2004 Printable Copy Create Case

Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L7	l5 and L6	8	L7
L6	restrain$	371166	L6
L5	l3 and L4	13	L5
L4	crash	33587	L4
L3	rear adj side adj impact	79	L3
L2	rear and L1	1	L2
L1	6212456.pn. or 6513831.pn.	4	L1

END OF SEARCH HISTORY

For 10/600853

First Hit Fwd Refs

☐ Generate Collection Print

DOCUMENT-IDENTIFIER: US 6415882 B1
TITLE: Deployable hinge for pedestrian protection vehicle hood

Brief Summary Text (2):
The present invention relates generally to a vehicle hood that is deployable upwardly in response to the vehicle impacting a pedestrian to provide additional crush space between the hood and underhood components, and more specifically to a hinge permitting normal opening and closing of the hood prior to deployment and that securely restrains the hood against rearward movement when in the deployed condition.

Detailed Description Text (5):
During normal vehicle operating conditions, the pivot 16 is retained in pin retention pocket 28 so that hinge 22 and attached hood 14 may be rotated relative to vehicle body structure 12 between a closed position shown in FIGS. 1 and 2 and an open position shown in FIG. 4. The width of pin retention pocket 28 is sufficiently larger than the diameter of slot first section 16c to allow hinge 22 and hood 14 to rotate freely. The width of neck portion 30 is sufficiently smaller than slot first section 16c to retain the pivot 16 in pin retention pocket 28 and prevent the hinge 22 and hood trailing edge from being lifted relative to vehicle body structure 12 during normal vehicle operations. A deployment cylinder 40 is secured to vehicle body structure 12 immediately below hinge 22 and comprises a vertically movable piston 42 driven by a pyrotechnic charge 44. Deployment cylinder 40 is activated by a control system indicated schematically at 48 in FIG. 1. The control system 48 comprises a pedestrian impact sensor 50, which may detect physical impacts with the vehicle or may be a pre-impact detector utilizing, for example, radar, laser, sonar, optical, or any other appropriate remote detection means. A control module 52 receives signals from sensor 50, evaluates the signals, and activates deployment cylinder 40 when the signals indicate that the vehicle has struck or is about to strike a pedestrian.

L7: Entry 15 of 15 File: USPT Feb 4, 2003

DOCUMENT-IDENTIFIER: US 6513831 B2
TITLE: Method and system for communicating between sensors and a supplemental restraint system controller

Abstract Text (1):
A system and method for communicating between a single electronic controller and multiple sensor devices in a vehicle supplemental restraint system includes a unique communication protocol. A series of pulses, each having a chosen duration, are communicated between the sensor device and the controller. The combined sequence and duration of each pulse provides a unique piece of information to the controller regarding the condition sensed by each sensor device, respectively. By controlling the sequence and duration of pulses, each sensor device is able to provide unique information to the controller, which responsively controls the supplemental restraint device as needed.

Brief Summary Text (3):
Supplemental restraint systems have recently gained increasing popularity in vehicles. The use of supplemental restraint devices such as air bags has been recognized as an advantage for preventing injury and preserving lives in the event of a vehicle crash. As technology has advanced, there have been additional proposals for additional supplemental restraint systems within vehicles. With the addition of each such device, additional communication is required between a controller and the device.

Brief Summary Text (4):
There have also been developments for including additional sensors on a vehicle for better detecting vehicle impact conditions. Moreover, with the increase of supplemental restraint devices, increased number of sensors are required for controlling each device. There is a need for effective communication between the various sensors or devices and the controller, which is responsible for deploying the supplemental restraint device as needed.

Brief Summary Text (5):
The need for communication between additional devices and sensors is coupled with the desire to maintain vehicle systems as simple, robust and economic as possible. Supplemental restraint systems, like most auxiliary systems incorporated into vehicles, must fit within space constraints and be cost effective.

Brief Summary Text (8):
In general terms, this invention is a system for controlling a supplemental restraint device in a vehicle using a simple and robust yet versatile communication protocol between the various devices of the supplemental restraint system. The inventive arrangement includes a plurality of sensor devices supported at peripheral locations on the vehicle. A controller that communicates with the sensor devices interprets a series of pulses that each have a chosen duration to determine a condition sensed by the sensor devices based upon the duration and sequence of the pulses. Each sensor device preferably provides a unique series of pulses to be interpreted by the controller providing information regarding the unique condition

sensed by each sensor.

Brief Summary Text (10):
A method of this invention includes communicating between a peripheral sensor device and an electronic controller in a vehicle safety system. The method includes generating a plurality of pulses in a series responsive to a condition sensed by the sensor device. Each pulse has a chosen duration such that the sequence and durations of the pulses are indicative of the sensed condition. The combination of the order in which the pulses are received and their respective durations provides unique information regarding the condition detected by the sensor device. The condition sensed by the sensor device is determined by the electronic controller based upon the duration and sequence of the pulses. The electronic controller is then able to responsively control the operation of the supplemental restraint device needed.

Detailed Description Text (2):
A vehicle 20 includes a supplemental restraint system 22. At least one supplemental restraint device 24 such as an air bag is operated responsive to conditions experienced by the vehicle such as impact, for example. A controller 26 controls the operation or deployment of the supplemental restraint device 24. Although one air bag 24 is schematically illustrated in FIG. 1, those skilled in the art will recognize that a system designed according to this invention is effective for controlling a plurality of air bags or other safety devices within a vehicle.

Detailed Description Text (3):
A plurality of peripheral sensing devices 28, 30, 32 and 34 provide information to the controller 26 regarding the conditions of the portions of the vehicle in the vicinity of each sensor device. The illustrated example includes electronic front sensors 32 and 34. The communication protocol of this invention allows the single controller 26 to receive information from all of the peripheral sensors and to readily interpret that information to control the supplemental restraint devices within the supplemental restraint system 22 as needed.

Detailed Description Text (4):
Four peripheral sensor devices are schematically illustrated in FIG. 1, however, this invention is not limited to that number of sensor devices and, is intended to be used with more than four sensor devices. Regardless of the type of sensor device, the communication protocol of this invention can be readily implemented to provide effective communication between a single controller 26 and multiple sensor devices.

Detailed Description Text (15):
FIG. 4 schematically illustrates somewhat more detail of the system 22. An example sensor device 32 is shown having a sensor portion 70 that detects a condition of the vehicle during an impact, for example. Such sensors are known in the art. A microcontroller portion 72 preferably includes a memory module 74 that contains interpretive information for interpreting the signals received from the sensor portion 70. One example memory module 74 is a look up table from which the microcontroller 72 determines the sequence and duration of the pulses to communicate to the controller 26 to provide a message indicating the sensed condition. The sensor device 32 preferably includes a power source portion 76 for powering the microcontroller portion 72 and the sensor portion 70.

CLAIMS:

1. A method of communicating between an electronic sensor having a sensor portion, a sensor controller and a current absorbing portion and an electronic controller in a vehicle safety system, comprising the steps of: generating a plurality of pulses in a series responsive to a condition sensed by the sensor by selectively controlling the current absorbing portion responsive to the condition sensed by the

sensor portion, each pulse having a chosen duration such that the sequence and durations of the pulses are indicative of the sensed condition; powering the sensor using the sensor controller and determining an amount of time that an amount of current exceeding a chosen threshold is drawn by the sensor from the controller to determine the pulse durations; and determining a condition sensed by the sensor using the electronic controller based upon the duration and sequence of the pulses.

2. The method of claim 1, including controlling the vehicle safety system responsive to the determined condition.

8. A system for controlling a supplemental restraint device in a vehicle comprising: a plurality of sensor devices supported at peripheral locations on the vehicle each sensor device having a sensor portion that generates an electrical signal responsive to a condition of the vehicle, a current absorbing portion and a microprocessor portion that controls the current absorbing portion to thereby generate a series of pulses based upon the electrical signal from the sensor portion, the microprocessor determining an amount of current drawn by the sensor portion and responsively controlling the current absorbing portion such that the duration and sequence of the pulses is indicative of the condition sensed by the sensor portion; and a controller that communicates with the sensor devices by interpreting the series of pulses that each have a chosen duration to determine a condition sensed by the sensor devices based upon the duration and sequence of the pulses.

12. A method of communicating between a peripheral sensor device and an electronic controller in a vehicle safety system, comprising the steps of: generating a plurality of pulses in a series responsive to a condition sensed by the sensor device, each pulse having a chosen duration such that the sequence and durations of the pulses are indicative of the sensed condition; establishing a set number of pulses included in the series; generating a separator signal portion in between successive series; and determining a condition sensed by the sensor device using the electronic controller based upon the duration and sequence of the pulses.

L9: Entry 2 of 2 File: USPT Apr 3, 2001

DOCUMENT-IDENTIFIER: US 6212456 B1
TITLE: Pedestrian impact sensor system

Abstract Text (1):
A pedestrian impact sensor system for a motor vehicle comprises sensor (4) for measuring the loads acting simultaneously on different regions across the front of the vehicle to produce pressure patterns (12a and 12b). The system includes a signal processor (14) for monitoring changes in measured pressure patterns over time, and for comparing these changes with data characteristic of pedestrian collisions. If a correspondence is identified, a signal is sent to activate a cushioning device (16).

Brief Summary Text (2):
The present invention relates to an impact sensor system for use in triggering operation of a deployable device for protecting a pedestrian hit by the front of a vehicle. The invention also relates to an impact sensing method and to a pedestrian protection system which employs the impact sensor system.

Brief Summary Text (5):
Cushioning devices require a sensor to be used to detect pedestrian impacts, and it is highly desirable for that sensor to discriminate between impact with a pedestrian and other types of impact. The decision of whether to deploy or not to deploy must be made in a very short space of time after detecting an initial impact at the front of the vehicle.

Brief Summary Text (6):
One pedestrian impact sensor system which has been proposed is described in International Patent Application No. WO 97/18108. This system uses a first sensor on the front bumper (fender) and a second sensor on the front edge of the hood of the vehicle. By measuring the time difference between triggering of the first sensor and triggering of the second sensor, and the magnitudes of the signals from those sensors, the system can distinguish between impacts with pedestrians and other sorts of impacts.

Brief Summary Text (7):
It is necessary for there to be an impact between the pedestrian and the vehicle hood before any deployment of a safety device can be triggered.

Brief Summary Text (9):
According to an aspect of the present invention there is provided a pedestrian impact sensing system for a motor vehicle comprising: a front end assembly mounted on a front end of the vehicle; a cushioning device mounted to the vehicle; memory means for storing pressure pattern data characteristic of pedestrian collisions; sensing means for measuring the loads acting simultaneously on different regions across the front end assembly to produce a pressure pattern; means for monitoring changes in measured pressure patterns over time; means for comparing the changing pressure patterns with stored pressure pattern data; and means for sending a triggering signal for activating the cushioning device when a correspondence is

identified between the monitored changing pressure pattern and stored pressure pattern data.

Brief Summary Text (11):
Preferably the sensing means are located in the front bumper of the vehicle. This permits the use of a single pressure sensitive matrix associated with the bumper. For convenience hereinafter the invention will be described with reference to a pressure sensitive matrix in a front bumper. However, it is to be understood that the invention is not limited to this embodiment.

Brief Summary Text (12):
The pressure pattern, rather than the magnitude of loading of individual matrix cells, principally characterises a pedestrian impact, while the change of pressure pattern with time provides discrimination data relating to magnitude. An advantage of this system is that variation in material properties of the bumper system, for example due to environmental effects or manufacturing variation, may affect the magnitude of load measured by individual cells, but will not significantly affect the pressure pattern.

Brief Summary Text (15):
The pressure sensitive matrix may be sandwiched between a rigid bumper beam and the bumper cover or trim panel. An energy absorbing module, for example a foam module, is preferably held under compression against the matrix. The matrix may be sandwiched between the foam module and the bumper beam, between the foam module and the bumper cover, or within the foam module.

Brief Summary Text (16):
In a particularly preferred embodiment, the bumper is provided with a plurality of discrete loading features, each corresponding to a region of the bumper where an element of the pressure pattern is to be measured. Each loading feature may comprise a projection in the bumper cover, in the foam module, or in the pressure sensitive matrix. The loading features improve load transmission to the sensor elements of the matrix.

Brief Summary Text (17):
Any vehicle systems that use a radiated field (for example radar, infrared, ultrasound, or microwave) to establish conditions outside the vehicle exterior could be used as a low-level trigger to activate a high processing rate in the impact sensor system. For example, if an automatic cruise control system sensed relative movement between the vehicle and an external object, the pedestrian impact sensor could commit system resources to discriminating an impact, given the higher level of event confidence gained. This information could also be used in the deployment decision-making process, similar to an interior airbag controller's "safing" sensor.

Brief Summary Text (18):
A further aspect of the present invention provides a method for detecting pedestrian impact with a motor vehicle, comprising: measuring loads acting simultaneously across the front of the vehicle to produce a pressure pattern; monitoring changes in measured pressure patterns over time; comparing the changing pressure patterns with stored data for changing pressure patterns characteristic of pedestrian collisions to determine if there is a correspondence; and sending a triggering signal to activate a cushioning device if a correspondence is identified.

Drawing Description Text (3):
FIG. 1 is an exploded view of a vehicle bumper for use in a pedestrian impact sensor system in accordance with an embodiment of the present invention;

Drawing Description Text (6):

FIG. 4 shows graphically an example of information presented by sensing means to a signal processor in a pedestrian impact sensor system in accordance the first embodiment of the present invention;

Detailed Description Text (2):
Referring to FIGS. 1-5a, a vehicle bumper portion 1 of a front end assembly is shown that comprises a rigid beam 2 and a cover 8. Sandwiched between the beam 2 and the cover 8 are a pressure sensitive matrix 4 and a foam module 6. The foam module 6 is held in compression against the pressure sensitive matrix 4 so that the force of an impact of an object against the cover 8 is partially transmitted to the matrix 4.

Detailed Description Text (4):
Examples of the type of pressure patterns transmitted from the pressure sensitive matrix 4 to the signal processor 14 are shown in FIG. 4. Picture elements from left to right as viewed correspond to sensing regions-across the bumper 1, and picture elements from top to bottom as viewed correspond to sensing regions up and down the bumper 1. The left hand pressure pattern 12a is measured at about five microseconds after an impact, and the right hand pressure pattern 12b is measured at about fifteen microseconds. In this illustration, each picture element can have only three states, namely high, medium, and low pressure. It would of course be possible to make the system more discriminating by measuring finer differences in pressure, or by providing a greater density of sensing regions. This increased discrimination would be at the cost of increasing the necessary processing resources to analyse the greater amount of data in the changing pressure patterns. The allocation of higher processing resources to the pedestrian impact system could be increased in response to a signal from a vehicle system which detects relative movement between the vehicle and an external object.

CLAIMS:

1. A pedestrian impact sensing system for a motor vehicle comprising:

a front end assembly mounted on a front end of the vehicle;

a cushioning device mounted to the vehicle;

memory means for storing pressure pattern data characteristic of pedestrian collisions;

sensing means for measuring the loads acting simultaneously on different regions across the front end assembly to produce a pressure pattern;

means for monitoring changes in measured pressure patterns over time;

means for comparing the changing pressure patterns with stored pressure pattern data; and

means for sending a triggering signal for activating the cushioning device when a correspondence is identified between the monitored changing pressure pattern and stored pressure pattern data.

2. A pedestrian impact sensing system as claimed in claim 1, wherein the front end assembly includes a bumper assembly and the sensing means is housed in the bumper assembly.

3. A pedestrian impact sensing system as claimed in claim 2, wherein the bumper assembly includes a rigid bumper beam and a bumper cover, and the sensing means is sandwiched between the rigid bumper beam and the bumper cover.

4. A pedestrian impact sensing system as claimed in claim 3, wherein the bumper assembly further includes an energy absorbing module that is held in compression between the bumper cover and the sensing means.

5. A pedestrian impact sensing system as claimed in claim 4, wherein the bumper assembly is provided with a plurality of discrete loading features, each corresponding to a region of the bumper assembly where an element of the pressure pattern is to be measured.

6. A pedestrian impact sensing system as claimed in claim 5, wherein the loading features comprise nubs or projections on the energy absorbing module.

7. A pedestrian impact sensing system as claimed in claim 1, wherein the sensing means comprises a pressure sensitive matrix.

8. A pedestrian impact sensing system as claimed in claim 1, wherein the means for comparing comprises a neural network.

9. A pedestrian impact sensing system as claimed in claim 1, further including means for detecting relative movement between the vehicle and an external object, means for producing a signal in response to detection of this movement, and means for increasing system resources available to the comparison means in response to the signal.

10. A method for detecting pedestrian impact with a motor vehicle, comprising:

measuring loads acting simultaneously across the front of the vehicle to produce a pressure pattern;

monitoring changes in measured pressure patterns over time;

comparing the changing pressure patterns with stored data for changing pressure patterns characteristic of pedestrian collisions to determine if there is a correspondence; and

sending a triggering signal to activate a cushioning device if a correspondence is identified.

L14: Entry 10 of 17 File: USPT Jun 15, 2004

DOCUMENT-IDENTIFIER: US 6749218 B2
TITLE: Externally deployed airbag system

Abstract Text (1):
Externally deployed airbag system for a vehicle including one or more inflatable airbags deployable outside of the vehicle, an anticipatory sensor system for assessing the probable severity of an impact involving the vehicle based on data obtained prior to the impact and initiating inflation of the airbag(s) in the event an impact above a threshold severity is assessed, and an inflator coupled to the anticipatory sensor system and the airbag for inflating the airbag when initiated by the anticipatory sensor system. The airbag may be housed in a module mounted along a side of the vehicle, in a side door of the vehicle (both for side impact protection), at a front of the vehicle (for frontal impact protection) or at a rear of the vehicle (for rear impact protection). Also, the externally deployed airbag can be deployed to cushion a pedestrian's impact against the vehicle.

Brief Summary Text (2):
The present invention relates to airbag inflation apparatus and method including an externally deployed airbag and more particularly, to airbag inflation apparatus and methods wherein the externally deployed airbag is inflated based on a crash signal from an anticipatory sensor.

Brief Summary Text (6):
Some understanding of the severity of the side impact problem can be obtained by a comparison with frontal impacts. In the Federal Motor Vehicle Safety Standard (FMVSS) 208 49 kph crash test which applies to frontal impacts, the driver, if unrestrained, will impact the steering wheel at about 30 kph. With an airbag and a typical energy absorbing steering column, there is about 40 cm to about 50 cm of combined deflection of the airbag and steering column to absorb this 30 kph difference in relative velocity between the driver and vehicle interior. Also, there is usually little intrusion into the passenger compartment to reduce this available space.

Brief Summary Text (7):
In the FMVSS 214 standard crash for side impacts, the occupant, whether restrained or not, is impacted by the intruding vehicle door also at about 30 kph. In this case there is only about 10 to 15 cm of space available for an airbag to absorb the relative velocity between the occupant and the vehicle interior. In addition, the human body is more vulnerable to side impacts than frontal impacts and there is usually significant intrusion into the passenger compartment. A more detailed discussion of side impacts can be found in a paper by Breed et al, "Sensing Side Impacts", Society of Automotive Engineers Paper No. 940651, 1994, which is incorporated by reference herein.

Brief Summary Text (8):
Ideally, an airbag for side impact protection would displace the occupant away from the intruding vehicle door in an accident and create the required space for a sufficiently large airbag. Sensors used for side impact airbags, however, usually begin sensing the crash only at the beginning of the impact at which time there is insufficient time remaining to move the occupant before he is impacted by the

intruding door. Even if the airbag were inflated instantaneously, it is still not possible to move the occupant to create the desired space without causing serious injury to the occupant. The problem is that the sensor that starts sensing the crash when the impact has begun, is already too late, i.e., once the sensor detects the crash, it is usually too late to properly inflate the airbag.

Brief Summary Text (12):
Although the main application for anticipatory sensors is in side impacts, frontal impact anticipatory sensors can also be used to identify the impacting object before the crash occurs. Prior to going to a full frontal impact anticipatory sensor system, neural networks can be used to detect many frontal impacts using data in addition to the output of the normal crash sensing accelerometer. Simple radar or acoustic imaging, for example, can be added to current accelerometer based systems to give substantially more information about the crash and the impacting object than possible from the acceleration signal alone.

Brief Summary Text (18):
International Publication No. WO 86/05149 (Karr et al.) describes a device to protect passengers in case of a frontal or rear collision. The device includes a measurement device mounted in connection with the vehicle to measure the distance or speed of the vehicle in relation to an object moving into the range of the vehicle, e.g., another vehicle or an obstacle. In the event that prescribed values for the distance and/or relative speed are not met or exceeded, i.e., which is representative of a forthcoming crash, a control switch activates the protection and warning system in the vehicle so that by the time the crash occurs, the protection and warning system has developed its full protective effect. Karr et al. is limited to frontal crashes and rear crashes and does not appear to even remotely relate to side impacts. Thus, Karr et al. only shows the broad concept of anticipatory sensing in conjunction with frontal and rear crashes.

Brief Summary Text (19):
U.S. Pat. No. 4,966,388 (Warner et al.) relates to an inflatable system for side impact crash protection. The system includes a folded, inflatable airbag mounted within a door of the vehicle, an impact sensor also mounted within the door and an inflator coupled to the impact sensor and in flow communication with the airbag so that upon activation of the inflator by the impact sensor during a crash, the airbag is inflated.

Brief Summary Text (20):
U.S. Pat. No. 3,741,584 (Arai) shows a pressurized air container and two air lines leading to a protective air bag. An air line passes through a first valve which is controlled by an anticipatory sensor and the other air line passes through a second valve controlled by an impact detector. The purpose of having two sensors associated with different valves is to ensure that the protective bag will inflate even if one of the crash sensors does not operate properly.

Brief Summary Text (22):
U.S. Pat. No. 3,874,695 (Abe et al.) shows an inflating arrangement including two inertia-responsive switches and coupled gas-generators. The gas-generators are triggered by the switches to inflate an airbag. The switches are both crash sensors and measured acceleration produced during the collision, and thus are not anticipatory sensors. The purpose of the two switches operative to trigger respective gas-generators is to enable the airbag to be inflated to different degrees. For example, if the crash involving the vehicle is a low speed crash, then only switch is actuated and gas-generated is triggered and the airbag will be inflated to part of its full capacity.

Brief Summary Text (28):
It is yet another object of the invention to provide a new and improved arrangement and method for deploying an external airbag in which an anticipatory sensor is used

to determine an impending crash and initiate deployment of the airbag to counter the force of the colliding object.

Brief Summary Text (50):
21. To provide a new and improved system and method for inflating an airbag based on information obtained by an anticipatory sensor and one or more additional crash sensors which provide information about the crash after the crash has begun and adjust the pressure in the airbag, if necessary.

Brief Summary Text (53):
Accordingly, some embodiments of the invention comprises an anticipatory crash sensor arrangement which provides information about an object such as a vehicle about to impact the resident vehicle, i.e., the vehicle in which the anticipatory crash sensor arrangement is situated, and causes inflation of one or more airbags, specifically, one or more airbags arranged to deploy outside of the vehicle

Brief Summary Text (59):
The invention is also applicable for pedestrian protection in the event of a crash and for this purpose, the anticipatory sensor system may be designed to assess the probable severity of an impact between a pedestrian and the vehicle based on data obtained prior to the impact. One or more airbags would be deployed to cushion impact of the pedestrian against the vehicle. In this regard, if several externally deployable airbags are provided on the vehicle, the anticipatory sensor system can be designed to determine which airbag(s) is to be deployed to provide for protection of any occupants of the vehicle and operationally deploy the airbag(s).

Brief Summary Text (60):
Another crash sensor arrangement is preferably also resident on the vehicle and provides information about the impact which may be used to adjust the pressure in a deploying airbag based on the information about the impact, if any such adjustment is determined to be required. Adjustment of the pressure may entail increasing the pressure in the airbag by, directing additional gas into the airbag(s), or releasing a control amount and/or flow of gas from the airbag(s).

Drawing Description Text (6):
FIG. 3A a plan front view of the front of a car showing the headlights, radiator grill, bumper, fenders, windshield, roof and hood;

Drawing Description Text (7):
FIG. 3B a plan front view of the front of a truck showing the headlights, radiator grill, bumper, fenders, windshield, roof and hood;

Drawing Description Text (11):
FIG. 7 is a front view of an occupant being restrained by a seatbelt having two anchorage points on the driver's right side where the one is released allowing the occupant to be laterally displaced during the crash;

Drawing Description Text (14):
FIG. 8 is a front view of an occupant being restrained by a seatbelt integral with seat so that when seat moves during a crash with the occupant, the belt also moves allowing the occupant to be laterally displaced during the crash;

Drawing Description Text (15):
FIG. 9A is a front view of an occupant being restrained by a seatbelt and a linear airbag module attached to the seat back to protect entire occupant from his pelvis to his head;

Drawing Description Text (17):
FIG. 10A is a front view of an occupant being restrained by a seatbelt and where the seat is displaced toward vehicle center by the deploying airbag in conjunction

with other apparatus;

Drawing Description Text (18):
FIG. 10B is a front view of an occupant being restrained by a seatbelt and where the seat is rotated about a vertical axis in conjunction with other apparatus;

Drawing Description Text (19):
FIG. 10C is a front view of an occupant being restrained by a seatbelt and where the seat is rotated about a longitudinal axis in conjunction with other apparatus;

Detailed Description Text (13):
A focusing system, such as used on some camera systems, could be used to determine the position of an approaching vehicle when it is at a significant distance away but is too slow to monitor this position just prior to a crash. This is a result of the mechanical motions required to operate the lens focusing system. By itself, it cannot determine the class of the approaching object but when used with a charge coupled, or CMOS, device plus infrared illumination for night vision, and an appropriate pattern recognition system, this becomes possible.

Detailed Description Text (20):
FIG. 3A is a plan front view of the front of a car showing the headlights, radiator grill, bumper, fenders, windshield, roof and hood and other objects which reflect a particular pattern of waves whether acoustic or electromagnetic. Similarly, FIG. 3B is a plane frontal view of the front of a truck showing the headlights, radiator grill, bumper, fenders, windshield, roof and hood illustrating a significantly different pattern. Neural network pattern recognition techniques using software available from NeuralWare Corp. of Pittsburgh, Pa. can be used to positively classify trucks as a different class of objects from automobiles and further to classify, different types of trucks giving the ability to predict accident severity based on truck type and therefore likely mass, as well as velocity. Other software tools are also commercially available for creating neural networks and fuzzy logic systems capable of recognizing patterns of this type.

Detailed Description Text (23):
Thus, the variable inflation rate inflator system for inflating the airbag 505 comprises inflators 530, 540 for producing a gas and directing the gas into the airbag 505, and crash sensors (as described in any of the embodiments herein or otherwise available) for determining that a crash requiring an airbag will occur or is occurring and, upon the making of such a determination, triggering the inflator (s) 530 and/or 540 to produce gas and direct the gas into the airbag 505 to thereby inflate the same at a variable inflation rate, which depends on whether only inflator 530 is triggered, only inflator 540 is triggered or both inflators 530, 540 are triggered (see FIG. 12).

Detailed Description Text (24):
More particularly, the inflator 540 may be associated with an anticipatory crash sensor to be triggered thereby and the inflator 530 may be associated with the anticipatory crash sensor or another different sensor, such as one which detects the crash only after it has occurred. In this manner, inflator 540 will be triggered prior to inflator 530 and inflator 530, if triggered, will supply an additional amount of gas into the airbag 505.

Detailed Description Text (26):
As shown in FIG. 13, a first crash sensor 526 is an anticipatory sensor and determines that a crash requiring deployment of the airbag 505 is about to occur and initiates deployment prior to the crash of substantially concurrent with the crash. Thereafter, a second crash sensor 528, which may be an anticipatory crash sensor (possibly even the same as crash sensor 526) or a different type of crash sensor, e.g., a crush sensor or acceleration based crash sensor, provides information about the crash before it occurs or during its occurrence and controls

vent control means 542 to adjust the pressure in the airbag. The vent control means 542 may be a valve and control system therefor which is situated or associated with a conduit connected to the outflow port or vent 544 at one end and at an opposite end to any location where the pressure is lowered than in the airbag whereby opening of the valve causes flow of gas from the airbag through the conduit and valve.

Detailed Description Text (27):
Specifically, the vent control means 542 adjust the flow of gas through the port or vent 544 in the airbag 505 (FIG. 5) to enable removal of a controlled amount of gas from the airbag 505 and/or enable a controlled flow of gas from the airbag 505. In this manner, the airbag 505 can be inflated with the maximum pressure prior to or substantially concurrent with the crash and thereafter, once the actual crash occurs and additional, possibly better, information is known about the severity of the crash, the pressure in the airbag is lowered to be optimal for the particular crash (and optimally in consideration of the position of the occupant at that moment).

Detailed Description Text (28):
In the alternative, the vent control means 542 can be controlled to enable removal of gas from the airbag 505 concurrent with the generation of gas by the inflator 540 (and optionally 530). In this manner, the rate at which gas accumulates in the airbag 505 is controllable since gas is being generated by inflator 540 (and optionally inflator 530, dependent on the anticipated severity of the crash) and removed in a controlled manner via the outflow port or vent 544.

Detailed Description Text (32):
An alternate system is shown in FIG. 7 which is a frontal view of an occupant 710 being restrained by a seatbelt 720 having two anchorage points 730 and 732 on the right side of the driver where the one 730 holding the belt at a point closest to the occupant 710 is released allowing the occupant 710 to be laterally displaced to the left in the figure during the crash. A detail of the release mechanism 730 taken within the circle 7A is shown in FIG. 7A.

Detailed Description Text (33):
The mechanism shown generally as 730 comprises an attachment bolt 744 for attaching the mechanism to the vehicle tunnel sheet-metal 740. Bolt 744 also retains a metal strip 742 connected to member 737. Member 737 is in turn attached to member 739 by means of explosive bolt assembly 736. Member 739 retains the seatbelt 720 by virtue of pin 738 (FIG. 7B). A stop 752 placed on belt 720 prevents the belt from passing through the space between pin 738 and member 739 in the event that the primary anchorage point 732 fails. Upon sensing a side impact crash, a signal is sent through a wire 734 which ignites explosive bolt 736 releasing member 737 from 739 and thereby inducing a controlled amount of slack into the seatbelt.

Detailed Description Text (34):
In some implementations, the vehicle seat is so designed that in a side impact, it can be displaced or rotated so that both the seat and occupant are moved away from the door. In this case, if the seatbelt is attached to the seat, there is no need to induce slack into the belt as shown in FIG. 8. FIG. 8 is a frontal view of an occupant 810 being restrained by a seatbelt 820 integral with seat 830 so that when seat 830 moves during a crash with the occupant 810, the seatbelt 820 and associated attachments 842, 844, 846 and 848 also move with the seat allowing the occupant 810 to be laterally displaced during the crash.

Detailed Description Text (35):
Various airbag systems have been proposed for protecting occupants in side impacts. Some of these systems are mounted within the vehicle seat and consist of a plurality of airbag modules when both the head and torso need to be protected. An illustration of the use of this module is shown in FIG. 9A, which is a frontal view

of an occupant 910 being restrained by a seatbelt 920 and a linear airbag module 930, of the type described in the aforementioned patent application, including among other things a housing 935 and an inflatable airbag 932 arranged therein and associated inflator means. This linear module is mounted by appropriate mounting means to the side of seat back 940 to protect the entire occupant 910 from his pelvis to his head. An anticipatory sensor may be provided as described above, i.e., one which detects that a side impact requiring deployment of the airbag is required based on data obtained prior to the crash and initiates inflation of the airbag by the inflator means in the event a side impact requiring deployment of the airbag is detected prior to the start of the impact.

Detailed Description Text (38):
In FIG. 10A, a frontal view of an occupant 1010 being restrained by a seatbelt 1020 and wherein the seat 1050 is displaced toward vehicle center, i.e., away from the side and side door of the vehicle, by deploying airbag 1040 is shown. In this case, the seatbelt 1020 is attached to the seat 1050 as described above with reference to FIG. 8. In this case, rail mechanisms 1062 and 1064 permit the seat to be displaced away from the door under the force produced by the deploying airbag 1040. Rail mechanisms 1062, 1064 may include a first member having a guide channel and a second member having a projection positioned for movement in the guide channel of the first member.

Detailed Description Text (41):
In FIG. 10B, a frontal view of an occupant 1010 being restrained by a seatbelt 1020 and wherein the seat 1050 is rotated toward vehicle center, i.e., substantially about an axis perpendicular to a horizontal plane of the vehicle, by deploying airbag 1040 is shown. In this case, the seatbelt 1020 is attached to the seat 1050 as described above with reference to FIG. 8. In this case, rail mechanisms 1066 and mounting locations 1068 permit the seat to be rotated away from the door under the force produced by the deploying airbag 1040. This figure is shown with the occupant rotated 90 degrees from initial position, this amount of rotation may be difficult for all vehicles. However, some degree of rotation about the vertical axis is possible in most vehicles. Rail mechanisms 1066 may include a first member having a curved guide channel and a second member having a projection positioned for a curving or rotational movement in the guide channel of the first member.

Detailed Description Text (42):
As shown in FIG. 10B, the seat 1050 is rotated in a clockwise direction so that the occupant is facing inward during the rotation. The rail mechanism 1066 can be designed to rotate the seat 1050 counterclockwise as well as along any rotational path. For example, in a frontal impact, it might be desirable to rotate the occupant toward the adjacent side door to enable the occupant to exit the vehicle via the side door and/or be extracted from the vehicle via the side door. Otherwise, if the occupant were to be rotated inward, the seat back would be interposed between the occupant and the side door and might hinder egress from the vehicle and extraction of the occupant from the vehicle after the crash.

Detailed Description Text (46):
Displacement of the seat 1050 could also be useful in rollover situations where the occupant would want to be displaceable in a particular direction depending on the nature of the rollover. Thus, a rollover sensor would replace the crash sensor, either the anticipatory crash sensor or the actual acceleration or crush sensors described above. Upon detection of a rollover, some action would be taken to inflate an airbag and enable movement of the seat when the force exerted by the inflation of the airbag is effective on the seat. One or more of the seat displacement enabling system could be incorporated into the vehicle so that one or more of these systems activated upon the detection of a rollover, depending on which motion of the seat and occupant would best benefit the occupant.

Detailed Description Text (54):

For example, FIGS. 14A and 14B show an externally deployable airbag mounted at the front of a vehicle so as to provide frontal impact protection. The airbag may be mounted in a housing or module in and/or proximate the bumper, fender, grille, or other part at the front of the vehicle. By using anticipatory sensing and/or exterior object identification as discussed above, the airbag is deployed prior to or at the moment of impact.

Detailed Description Text (55):
FIGS. 15A and 15B show an externally deployable airbag mounted at the rear of a vehicle so as to provide rear impact protection. The airbag may be mounted in a housing or module in and/or proximate the bumper or another part at the rear of the vehicle. By using anticipatory sensing and/or exterior object identification as discussed above, the airbag is deployed prior to or at the moment of impact.

Detailed Description Text (56):
FIGS. 16A and 16B show an externally deployable airbag mounted at the front of a vehicle for a situation where pedestrian protection is obtained. The airbag may be mounted in a housing or module in and/or proximate the bumper, fender, grille, or other part at the front of the vehicle. By using anticipatory sensing and/or exterior object identification as discussed above, the airbag is deployed prior to or at the moment of impact to protect the pedestrian. It can be seen by comparing FIG. 14B and FIG. 16B that the airbag for pedestrian protection deploys over the hood of the vehicle instead of in front of the vehicle. In a similar manner, an airbag for pedestrian impact protection at the rear of a vehicle would be arranged to deploy over the trunk instead of rearward as shown in FIG. 15B.

Detailed Description Text (58):
It is envisioned that the features of the side impact protection systems, rear impact protection systems, frontal impact protection systems, and pedestrian impact protection systems can be used interchangeably to the extent possible. Thus, features of the side impact protection systems can be used for rear, frontal and pedestrian impact protection.

Detailed Description Text (59):
In another embodiment of the invention using an anticipatory sensor system, a deploying airbag is used to pre-position the occupant. That is, an airbag is arranged and designed to move only a part of the occupant, not necessarily the seat, so as to make room for deployment of another airbag. For example, a shoulder or thorax airbag could be deployed based on a determination from an anticipatory sensor system that a crash is imminent and a determination from an interior monitoring system that the occupant's head is resting against the window. The deploying shoulder or thorax airbag would serve to push the occupant's head away from the window, making room for the deployment of a side curtain airbag between the window and the person's head. Such pre-positioning airbags could be strategically arranged in the vehicle to move different parts of an occupant in a specific direction and then deployed based on the position the occupant is in prior to the impact to change the occupant's status of "out-of-position" vis-a-vis airbag deployment to "in-position".

Detailed Description Text (62):
In general terms, disclosed above is an inflator system for inflating an airbag which comprises gas inflow means for inflating the airbag with gas, vent means for controlling removal of gas from the airbag, a first anticipatory crash sensor for determining that a crash requiring deployment of the airbag will occur based on data obtained prior to the crash and, upon the making of such a determination, directing the gas inflate the airbag, and a second crash sensor for determining that a crash requiring deployment of the airbag will occur or is occurring and, upon the making of such a determination, controlling the vent means to enable the removal of gas from the airbag whereby the pressure in the airbag is changed by the removal of gas therefrom enabled by the vent means.

Detailed Description Text (63):
The gas inflow means may be in the form of an inflator which is activated to produce gas and release the gas through conduits into the interior of the airbag. The gas inflow means can also be in the form of a tank of pressurized gas and a valve in a conduit leading from the tank to the interior of the airbag whereby opening of the valve causes flow of gas from the tank into the airbag. Any other type of structure or method which serves to cause accumulation of gas in the interior of the airbag can also be used as gas inflow means in accordance with the invention. The gas inflow means can also constitute multiple inflators which are independently activated based on, the severity of the anticipated crash. In this case, one inflator would be activated for a minor or average crash whereas for a more severe crash, two or more inflators would be activated thereby increasing the flow of gas into the airbag and the inflation rate and/or pressure therein. Each inflator could be controlled by the same or a different crash sensor.

Detailed Description Text (65):
The airbag may be, but is not required to be, a side airbag arranged to inflate between the occupant and the side door. Regardless of the direction of the crash which will causes deployment of the airbag, it is beneficial to provide some form of occupant displacement permitting means arranged in connection with the seat for permitting the occupant to be displaced away from the airbag mounting surface upon inflation of the airbag and thereby increase the space between the occupant and the airbag mounting surface. Thus, if the airbag is a side airbag mounted in the side door, it is beneficial to enable displacement of the occupant away from the side door. Such occupant displacement permitting or enabling means may be in the form of some structure which introduces slack into the seatbelt in conjunction with the deployment of the airbag or a mechanism by which the seat can be moved or is actually moved away from the side door, e.g., tilted inward.

Detailed Description Text (68):
Another embodiment of the inflator system comprises inflator means for releasing a gas into the at least one airbag, a first anticipatory crash sensor for determining that a crash requiring deployment of the airbag will occur based on data obtained prior to the crash and, upon the making of such a determination, triggering the inflator means to release gas into the airbag, and a second crash sensor for determining that a crash requiring deployment of the airbag will occur or is occurring and, upon the making of such a determination, changing the rate at which gas accumulates in the airbag. To this end, the second crash sensor is structured and arranged to control outflow of gas from the airbag. Outflow of gas from the airbag may be controlled via a variable outflow port.

Detailed Description Text (69):
A method for inflating an airbag comprises the steps of making a first determination by means of an anticipatory crash sensor that a crash requiring deployment of the airbag will occur based on data obtained prior to the crash and, upon the making of such a determination, inflating the airbag, and making a second, separate determination by means of a second crash sensor that a crash requiring deployment of the airbag will occur or is occurring and, upon the making of such a determination, changing the rate at which gas accumulates in the airbag. The rate at which gas accumulates in the airbag may be changed by enabling and regulating outflow of gas from the airbag.

Detailed Description Text (70):
Also disclosed herein is an airbag passive restraint system for protecting an occupant adjacent the door in a side impact which comprises an airbag arranged to inflate between the door and the occupant and a side impact anticipatory sensor for determining that an accident requiring deployment of the airbag is about to occur prior to the accident. The sensor is arranged to receive waves generated by, modified by or reflected from an object about to impact the vehicle resulting in

the accident and comprises identifying and determining means for identifying the object based on a pattern of the received waves and determining whether the identified object will cause an accident requiring deployment of the airbag. The system also includes an inflator coupled to the sensor for inflating the airbag if the sensor determines that an accident requiring deployment of the airbag is about to occur. The identifying and determining means may comprise a neural network trained on data of possible patterns of received waves in conjunction with an identification of the object the received waves have been generated by, modified by or reflected from. In the alternative, the identifying and determining means may comprise a fuzzy logic algorithm or a rule based pattern recognition algorithm. The sensor may be arranged to receive electromagnetic waves or acoustic waves.

Detailed Description Text (71):
Another disclosed embodiment of a system for triggering deployment of an airbag passive restraint system in anticipation of an accident between the vehicle and an object approaching the vehicle comprises transmitter means arranged on the vehicle for sending waves toward the object, receiver means arranged on the vehicle for receiving modified or reflected waves from the object and producing a signal representative of the waves, identifying and determining means for identifying the object based on a pattern of the received waves and determining whether the identified object will cause an accident requiring deployment of the passive restraint system and triggering means responsive to the identifying and determining for initiating deployment of the passive restraint system if the identifying and determining means determines that an accident requiring deployment of the passive restraint system is about to occur. The transmitter means may be arranged to transmit electromagnetic waves, such as radar waves, or ultrasonic waves. The identifying and determining means may comprise a neural network trained on data of possible patterns of received waves in conjunction with an identification of the object the received waves have been modified by or reflected from, a fuzzy logic algorithm or a rule based pattern recognition algorithm. The transmitter means may also comprise a laser transmitter and the receiver means comprise a charge coupled device or CMOS sensing array.

Detailed Description Text (72):
Still another disclosed embodiment of a system for triggering deployment of an airbag passive restraint system in anticipation of an accident between the vehicle and an object approaching the vehicle comprises receiver means for receiving electromagnetic waves generated, reflected or modified by the object, identifying and determining means for identifying the object based on a pattern of the received waves and determining whether the identified object will cause an accident requiring deployment of the passive restraint system and triggering means responsive to the identifying and determining means for initiating deployment of the passive restraint system if the identifying and determining means determines that an accident requiring deployment of the passive restraint system is about to occur. The receiver means may be arranged to receive light waves or infrared waves. As in the embodiments discussed above, the identifying and determining means may comprise a neural network trained on data of possible patterns of received waves in conjunction with an identification of the object the received waves have been generated, reflected or modified by, a fuzzy logic algorithm or a rule based pattern recognition algorithm. The receiver means may comprise a charge-coupled device or CMOS sensing array.

Detailed Description Text (73):
Also disclosed is a method for controlling deployment of a passive restraint system in anticipation of an accident with an approaching object which comprises the steps of mounting at least one receiver on the vehicle to receive waves generated by, modified by or reflected from an object exterior of the vehicle, conducting training identification tests on a plurality of different classes of objects likely to be involved in a vehicular accident, each of the tests comprising the steps of receiving waves generated by, modified by or reflected from the object by means of

the receiver(s) and associating an object class with data from each test, and generating an algorithm from the training test results, associated object classes and an indication as to whether deployment of the passive restraint system is necessary such that the algorithm is able to process information from the received waves from the receiver(s), identify the class of the object and determine whether deployment of the passive restraint system is necessary. During operational use, a plurality of waves generated by, modified by or reflected off an object exterior of the vehicle are received by means of the receiver(s) and the algorithm is applied using the received waves as input to identify the object exterior of the vehicle and determine whether deployment of the passive restraint system is necessary. At least one transmitter may be mounted on the vehicle to transmit waves toward the object exterior of the vehicle such that the waves are reflected off or modified by the object exterior of the vehicle and received by the receiver(s).

Detailed Description Text (74):
In some implementations, the sensor system may include a variable inflation rate inflator system for inflating the airbag(s). Such an inflator system comprises inflator means for releasing a gas into the airbag(s), a first anticipatory crash sensor for determining that a crash requiring an airbag will occur based on data obtained prior to the crash and, upon the making of such a determination, triggering the inflator means to release gas into the airbag(s) to thereby inflate the same at a first inflation rate, a second crash sensor for determining that a crash requiring an airbag will occur or is occurring and, upon the making of such a determination, affecting the inflator means such that an additional quantity of gas is released thereby into the airbag(s) to thereby inflate the same at a second inflation rate greater than the first inflation rate. The inflator means may comprise first and second inflators structured and arranged to produce gas and direct the gas into the airbag(s) and which are independent of one another such that the first inflator may be triggered by the first anticipatory sensor without triggering of the second inflator and the second inflator may be triggered by the second crash sensor without triggering of the first inflator.

Detailed Description Text (75):
In conjunction with the variable inflation rate inflator system described above, a method for providing a variable inflation rate of the airbag(s) is also envisioned. Such a method would entail determining that a crash requiring an airbag will occur based on data obtained prior to the crash, e.g., by an anticipatory sensor, and upon the making of such a determination, triggering an inflator to release gas into the airbag(s) to thereby inflate the same at a first inflation rate, determining in another manner that a crash requiring an airbag will occur or is occurring and, upon the making of such a determination, affecting the inflator such that an additional quantity of gas is released thereby into the airbag(s) to thereby inflate the same at a second inflation rate greater than the first inflation rate. Thus, the airbag is inflated either at the first inflation rate, i.e., if the conditions do not warrant a more powerful inflation, or the second, higher inflation rate, i.e., if the conditions warrant an inflation of the airbags as rapidly as possible. The inflator may comprise a first and second inflator each of which produces gas and directs the gas into the airbag(s) and which are independent of one another such that the first inflator may be triggered by the initial determination of a crash requiring the airbag deployment without triggering of the second inflator and the second inflator may be triggered by the subsequent determination of a crash requiring airbag deployment without triggering of the first inflator.

Detailed Description Text (76):
Furthermore, the anticipatory sensor system described above may be used in conjunction with an airbag passive restraint system for protecting an occupant sitting in the seat adjacent the side door. Such a restraint system may comprise one or more airbag(s) arranged to be inflated between the occupant and the side door, sensor means for detecting that a crash requiring deployment of the airbag(s)

is required, inflator means for releasing a gas into the airbag(s) to inflate the same and which are coupled to the sensor means and triggered thereby to release gas into the airbag(s) in response to the detection by the sensor means of a crash requiring deployment of the airbag(s), a seatbelt coupled to the seat for restraining the occupant on the seat and occupant displacement permitting means arranged in connection with the seat for permitting the occupant to be displaced away from the side door upon inflation of the airbag(s) and thereby increase the space between the occupant and the side door.

Detailed Description Text (78):
In another embodiment, the system includes mounting means for mounting the airbag adjacent the occupant and the sensor is an anticipatory sensor structured and arranged to detect that a crash requiring deployment of the airbag is required based on data obtained prior to the crash such that the inflator means are triggered to release gas into the airbag prior to the start of the crash. In this case, the occupant displacement permitting means are optionally operatively associated with the anticipatory sensor and the seat to increase the space between the occupant and the side door upon inflation of the airbag. The occupant displacement permitting means may comprise means for laterally displacing the seat away from the side door such as one or more rail mechanisms, each including a first member having a guide channel arranged in connection with the seat or the vehicle and a second member positioned for movement in the guide channel arranged in the other of the seat and the vehicle. Alternatively, the occupant displacement permitting means comprise means for rotating the seat about the vehicle roll axis, possibly also by rail mechanisms, means for rotating the seat about the vehicle yaw axis or means for lifting the seat vertically. The seat lifting means may comprise a first plate attached to the seat, a second plate attached to the vehicle and hingedly attached to the first plate, and a clamp for releasably retaining the first plate in connection with the second plate.

Detailed Description Text (79):
Any of the airbag passive restraint systems described herein may be used in conjunction with the variable inflation rate inflator system described above, and may be used in conjunction with one another to optimize protection for the occupant.

Detailed Description Text (80):
In conjunction with the airbag passive restraint system for protecting an occupant sitting in the seat adjacent the side door described above, the present invention also envisions a method for protecting such an occupant. Such a method would include the steps of detecting that a crash requiring deployment of one or more airbags is required, if so, releasing a gas into the airbag(s) to inflate the same and then in before, during or after the gas is released into the airbag, causing the occupant to be displaced away from the side door upon inflation of the airbag (s) to thereby increase the space between the occupant and the side door. The manner in which the occupant is caused to be displaced away from the side door may take any of the forms described herein.

Detailed Description Text (81):
Other methods for protecting an adjacent occupant in a side impact within the scope of the invention includes the steps of mounting an airbag module comprising a housing and an inflatable airbag arranged within the housing in combination with a seat back, detecting that a side impact requiring deployment of the airbag is required based on data obtained prior to the crash, e.g., by an anticipatory sensor, and then inflating the airbag in the event a side impact requiring deployment of the airbag is detected prior to the start of the impact.

Detailed Description Text (82):
Another possible method entails the use of an externally deployable airbag system for protecting the occupant in a side impact with an impacting object. This method

would include the steps of determining that a side impact requiring deployment of an airbag outside of the vehicle between the side of the vehicle and the impacting object is required based on data obtained prior to the crash, and then inflating the airbag in the event a side impact requiring deployment of the airbag is detected.